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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/627,206
Appellant : Harry Israel Ringermacher et al.
Filed : July 24, 2003
Title : INFRARED THERMOGRAPHY IMAGING SYSTEM WITH
ACTIVELY QUENCHED LAMP
TC/A.U. : 2859
Examiner : Gail Kaplan Verbitsky
Docket No. : 120631-1

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CORRECTED APPEAL BRIEF

This Corrected Appeal Brief is being filed in response to the Notification of Non-Compliant Appeal Brief dated May 29, 2007. Subheadings 7(B)(1) and 7(C)(1) have been added.

The Commissioner was previously authorized to charge the requisite fee of \$500.00 for submission of the Appeal Brief submitted April 12, 2007, and the Commissioner is hereby authorized to charge any additional fees, which may be necessary to advance prosecution of the present application, to Account No. 07-0868.

1. REAL PARTY IN INTEREST

The real party in interest is General Electric Company, the Assignee of the above-referenced application by virtue of the Assignment to General Electric Company by Harry Israel Ringermacher, Richard S. Zhang and Robert John Filkins. Accordingly, General Electric Company will be directly affected by the Board's decision in the pending appeal.

2. RELATED APPEALS AND INTERFERENCES

Appellant is unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellant's legal representative in this Appeal.

3. STATUS OF CLAIMS

Claims 1-14, 23-27 and 29 are cancelled in this application. Claims 15-22, 28 and 30 are currently pending, are currently under final rejection and, thus, are the subject of this Appeal.

4. STATUS OF AMENDMENTS

Appellant submitted an amendment dated January 12, 2007 in response to the final office action dated October 18, 2006. In the amendment, it was requested that paragraph 22 of the specification be amended and that Figure 9 be replaced to add reference character 30. There was no indication in the Advisory Action as to whether the amendment would or would not be entered. However, a February 6, 2007 posting in the USPTO's Public PAIR database consists of a handwritten note on the first page of the January 12, 2007 amendment that states "do not enter." Accordingly, Appellant assumes that the amendment dated January 12, 2007 was not entered.

5. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates generally to the field of infrared ("IR") thermography and, more particularly, to actively controlling the flash duration of an IR lamp for an IR thermography imaging system. See, Application page 1, paragraph 1.

The Application contains two pending independent Claims, 15 and 30, which are directed to IR thermography imaging systems. The subject matter of these independent claims is summarized below.

Discussions of the recited features of Claim 15 can be found in at least the following cited locations of the specification. By way of example, Figure 1 illustrates an actively quenched lamp embodiment of the invention, in block form, and Figure 9 illustrates an infrared thermography imaging system embodiment of the invention. Claim 15 is directed to an IR thermography imaging system 10 comprising at least one flash lamp 12 configured to heat a surface 42 of an object 40 to be imaged. (See Application, page 4, paragraph 21.) At least one active quenching means 14 is provided and configured to quench the at least one flash lamp 12 to control a duration of a flash. (See Application, page 4, paragraph 21.) The active quenching means 14 is configured to receive a control signal T2 and to quench the flash lamp 12 in response to the control signal T2. (See Application, page 5, paragraph 23 and Figures 2 and 3.) The IR thermography imaging system 10 further includes an IR camera 32 configured to capture a number of IR image frames of the object 40. (See Application, page 8, paragraph 31.)

Discussions of the recited features of Claim 30 can be found in at least the following cited locations of the specification. By way of example, Figure 3 shows an example of an active quenching means, in block form. Claim 30 is directed to an IR thermography imaging system 30 comprising at least one flash lamp 12 configured to heat a surface 42 of an object 40 to be imaged. (See Application, page 4, paragraph 21 and Figure 9.) At least one active quenching means 14 is provided and is configured to quench the at least one flash lamp 12 to control a duration of a flash. (See Application, page 4, paragraph 21 and Figure 9.) The active quenching means 14 is configured to receive a control signal T2 and to quench the flash lamp 12 in response to the control signal T2. (See Application, page 5, paragraph 23 and Figures 2 and 3.) The IR thermography imaging system 30 further includes an IR camera 32 configured to capture a number of IR image frames of the object 40. (See Application, page 8, paragraph 31.) The active quenching means is a switch 13 that opens in response to the control signal T2. (See Application, page 6, paragraph 28 and Figure 3.)

By way of example, an exemplary timing diagram for an actively quenched lamp 10 is shown in Figure 2. For the example illustrated in Figures 1 and 2, the active quenching means 14 receives an initial control signal T0 and allows current I to flow to the lamp 12 in response to the initial control signal T0. (See Application, page 5, paragraph 23.) As noted above, the active quenching means 14 receives a control signal T2 and quenches the lamp 12 in response to the control signal T2. (See Application, page 5, paragraph 23.) As indicated in Figure 3, for example, exemplary control signals T2 and T0 are the high and low portions, respectively, of a pulse signal. (See Application, page 5, paragraph 23.)

Benefits of the invention, as described in the specification, include active control of the duration of a flash for IR thermography, such that the desired flash duration may be selected for a given application. As shown in Figure 2 by the dashed line, without quenching, the flash has an exponential tail. This exponential tail would continue to heat the object during data acquisition, thereby distorting the thermal information in the data frames. A quenched flash is shown by the solid line. As shown in Figure 2, the flash has a duration D of about $D=T_2-T_1$. The desired duration D varies by application and is long enough to heat the surface of the object being inspected but short enough to end prior to acquisition of the data frames. Beneficially, by cutting off the exponential tail (shown by the dashed line in Figure 2), the active quenching means 14 reduces distortion of the thermal information in the data frames. In turn, reducing the distortion of the thermal information in the data frames permits a more accurate analysis. (See Application, page 6, paragraph 25 and Figure 2.)

This is a clear difference and distinction from the prior art, as discussed below.

6. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

First Ground of Rejection for Review on Appeal:

Appellant respectfully urges the Board to review and reverse the Examiner's first ground of rejection in which Claims 15-20 and 30 were rejected under 35 U.S.C. § 103(a), as being unpatentable over "Front Flash Thermal Imaging Characterization of Continuous Fiber Ceramic Composites" by C. Deemer, J.G.Sun, W.A.Ellingson, and S. Short, 23rd Annual Cocoa Beach

Int. Conf. On Engineering Ceramics and Structures, Jan. 25-29, 1999 (Deemer), in view of U.S. Patent No. 6,583,588 (Erhardt).

Second Ground of Rejection for Review on Appeal:

Appellant respectfully urges the Board to review and reverse the Examiner's second ground of rejection in which Claim 15 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Deemer, in view of U.S. Patent No. 6,759,793 (Narita).

Third Ground of Rejection for Review on Appeal:

Appellant respectfully urges the Board to review and reverse the Examiner's third ground of rejection in which Claims 21, 22 and 28 were rejected under 35 USC § 103(a) over Deemer, in view of Erhardt, in further view of "Integrated Gate-Commutated Thyristors: A New Approach to High Power Electronics," Eric Carroll et al., IGCT Press Conference, May 20, 1997.

7. ARGUMENT

As discussed in detail below, Claims 15-22, 28 and 30 define allowable subject matter over the cited art. Accordingly, Appellant respectfully requests full and favorable consideration by the Board.

A. Ground of Rejection No. 1:

The Examiner rejected Claims 15-20 and 30 under 35 U.S.C. § 103(a), as being unpatentable over Deemer, in view of Erhardt.

1. Legal basis required to establish a *prima facie* case of obviousness.

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes all of the claimed elements, but also a convincing line of reason as to why

one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

2. Claims 15-20 and 30 define allowable subject matter over Deemer, in view of Erhardt.

Claim 15 is directed to an infrared thermography imaging system that includes at least one active quenching means configured to quench at least one flash lamp *to control the duration of a flash*. The active quenching means is configured to receive a control signal T2 and to quench the flash lamp in response to the control signal T2. The duration of the flash is controlled, as described in paragraph 25 on page 6 of the specification, to control the amount of heat transferred to an object from the flash lamp. Without the ability to control the duration of a flash, the heat transferred to the object from the flash lamp would continue to heat the object during data acquisition, thereby distorting the thermal information in heat measurement camera data frames.

In support of the rejection of Claim 15, the Examiner cites Deemer as disclosing an infrared thermography imaging system. As noted by the Examiner, Deemer does not teach or suggest an active quenching means configured to quench at least one flash lamp to control the duration of a flash, as recited by Claim 15. In addition, the Examiner has not pointed to any recognition in Deemer of the need for an active quenching means.

Instead, the Examiner contends that it would have been obvious to one of ordinary skill in the art to add a control device, as taught by Erhardt, to the device of Article 1, so as to have a cyclic heating and cooling control of the illuminating means (lamp), so as to prevent lamp overheating. Erhardt is directed to a system for automatically turning off high intensity discharge (HID) lamps that need to be turned off at least once per week to maintain proper operation (Background in Col. 1). The automatic cycling control of Erhardt insures that lamps

are cycled at least once per week. (Col. 2, lines 11-15). Erhardt does not teach or suggest at least one active quenching means configured to quench at least one lamp to control a duration of a flash, wherein the active quenching means is configured to receive a control signal T2 and to quench the lamp in response to the control signal T2, as recited by Claim 15. Rather, the switching device 54 of Erhardt turns an HID lamp off and on. The HID lamp does not flash, and Erhardt thus does not provide an active quenching means *for controlling a duration of a flash*.

Furthermore, the Examiner's arguments to combine the two references neglect the different types of lamps used in the two references (flash lamps in Deemer and HID lamps in Erhardt), as well as their different time scales (the HID lamps are cycled off once every 168 hours and cooled for about fifteen minutes in Erhardt, as compared to the flash lamps in Deemer which would have a much shorter duration).

Further, even if the references are combined in the manner proposed by the Examiner, the teachings together neither disclose nor suggest an infrared thermography imaging system that includes at least one active quenching means configured to quench at least one flash lamp *to control the duration of a flash* as claimed in claim 15. Rather, the combination proposed by the Examiner, would merely turn off the flash lamp of Deemer for cooling and would not quench the flash lamp to control the duration of a flash.

Thus, Appellant respectfully submits that the cited art does not teach or suggest all of the claim limitations of Claim 15. Claims 16-20 depend from Claim 15. Accordingly, a prima facie case of obviousness has not been established for Claims 15-20, and Appellant requests that the Board overturn the rejection and allow Claims 15-20.

Turning to claim 30, Appellant respectfully submits that analogous arguments apply to Claim 30 and that the cited art does not teach or suggest all of the claim limitations of Claim 30. Accordingly, a prima facie case of obviousness has not been established for Claim 30, and Appellant requests that the Board overturn the rejection and allow Claim 30.

B. Ground of Rejection No. 2:

Claim 15 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Deemer, in view of Narita.

1. Claim 15 defines allowable subject matter over Deemer, in view of Narita.

Claim 15 is directed to an infrared thermography imaging system that includes at least one flash lamp configured to heat a surface of an object to be imaged and at least one active quenching means configured to quench at least one flash lamp *to control the duration of a flash*. The active quenching means is configured to receive a control signal T2 and to quench the flash lamp in response to the control signal T2.

In support of the rejection of Claim 15, the Examiner cites Deemer as disclosing an infrared thermography imaging system. As noted by the Examiner, Deemer does not teach or suggest an active quenching means configured to quench at least one flash lamp to control the duration of a flash, as recited by Claim 15. In addition, the Examiner has not pointed to any recognition in Deemer of the need for an active quenching means.

Instead, the Examiner contends that it would have been obvious to one of ordinary skill in the art to replace the flash lamp in Deemer with the arc lamp taught by Narita. Narita is directed to a lamp unit for a projector and does not teach or suggest at least one active quenching means configured to quench at least one flash lamp to control a duration of a flash, as recited by Claim 15. Instead, the Examiner has pointed to a cooling means 50 and a means 60 for changing the power of a mercury lamp.

Accordingly, even if the references are combined in the manner proposed by the Examiner, the teachings together neither disclose nor suggest an infrared thermography imaging system that includes at least one active quenching means configured to quench at least one flash lamp *to control the duration of a flash* as claimed in claim 15. Rather, the combination proposed by the Examiner would merely turn off the arc lamp of Narita to prevent the arc lamp from overheating and would not quench a flash lamp to control the duration of a flash.

As such, Appellant respectfully submits that the cited art does not teach or suggest all of the claim limitations of Claim 15. Accordingly, a prima facie case of obviousness has not been

established for Claim 15, and Appellant requests that the Board overturn the rejection and allow Claim 15.

C. Third Ground of Rejection:

Claims 21, 22 and 28 were rejected under 35 USC § 103(a) over Deemer, in view of Erhardt, in further view of Carroll.

1. Claims 21, 22 and 28 define allowable subject matter over Deemer, in view of Erhardt, in further view of Carroll.

Claims 21, 22 and 28 depend from Claim 15. As discussed above in sub-section A, Deemer and Erhardt do not disclose the active quenching means of Claim 15. The Examiner has cited Carroll for teachings regarding power semiconductor switches. However, Carroll does not supply the above-discussed deficiencies of Deemer and Erhardt.

Accordingly, Appellant respectfully submits that the cited art does not teach or suggest all of the claim limitations of Claims 21, 22 and 28. Accordingly, a prima facie case of obviousness has not been established for Claims 21, 22 and 28, and Appellant requests that the Board overturn the rejection and allow Claims 21, 22 and 28.

8. Conclusion

Appellant respectfully submits that all pending claims are in condition for allowance. However, if the Examiner or Board wishes to resolve any other issues by way of a telephone conference, the Examiner or Board is kindly invited to contact the undersigned legal representative at the telephone number indicated below.

Respectfully submitted,

/Penny A. Clarke/

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9. **APPENDIX OF CLAIMS ON APPEAL**

Listing of Claims:

15. An infrared ("IR") thermography imaging system comprising:

at least one flash lamp configured to heat a surface of an object to be imaged;

at least one active quenching means configured to quench said at least one flash lamp to control a duration of a flash, wherein said active quenching means is configured to receive a control signal T2 and to quench said flash lamp in response to the control signal T2; and

an IR camera configured to capture a plurality of IR image frames of the object.

16. The IR thermography imaging system of Claim 15, wherein said active quenching means is further configured to receive an initial control signal T0, and wherein said active quenching means is further configured to allow a current flow I to said flash lamp in response to the initial control signal T0.

17. The IR thermography imaging system of Claim 16, wherein said active quenching means comprises a switch, wherein said switch closes in response to the initial control signal T0 and opens in response to the control signal T2.

18. The IR thermography imaging system of Claim 17, further comprising a timing generator configured to supply the initial control signal T0 and the control signal T2 and to supply a lamp trigger signal T1, wherein said flash lamp is activated in response to the lamp trigger signal T1.

19. The IR thermography imaging system of Claim 16, wherein said active quenching means further comprises a switch drive circuit configured to receive a logic level signal and to generate a switch-drive signal in response, wherein the control signal T2 is a logic level signal, and wherein said high-voltage, high current switch opens in response to the switch-drive signal that corresponds to the control signal T2.

20. The IR thermography imaging system of Claim 19, wherein the switch-drive signal is a switch-drive voltage signal.

21. The IR thermography imaging system of Claim 17, wherein said switch comprises a power semiconductor switch.

22. The IR thermography imaging system of Claim 17, wherein said switch comprises an insulated gate bipolar transistor.

28. The IR thermography imaging system of Claim 21, wherein the power semiconductor switch is selected from the group consisting of a silicon controlled rectifier, a gate turn-on thyristor, a MOSFET, a insulated gate commutated thyristor ("IGCT"), and combinations thereof.

30. An infrared ("IR") thermography imaging system comprising:

at least one flash lamp configured to heat a surface of an object to be imaged;

at least one active quenching means configured to quench said at least one flash lamp to control a duration of a flash, wherein said active quenching means is configured to receive a control signal T2 and to quench said flash lamp in response to the control signal T2; and

an IR camera configured to capture a plurality of IR image frames of the object,
wherein said active quenching means is a switch, wherein said switch opens in response to the control signal T2.

10. APPENDIX OF EVIDENCE

None

11. **APPENDIX OF RELATED PROCEEDINGS**

None.